ARIZONA DEPARTMENT OF ECONOMIC SECURITY

POLICY NUMBER		
045Z 05-02-1 Index		
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SUBJECT	REVISION	EFFECTIVE DATE
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A. PURPOSE

To provide documentation which describes the method used in development of the Composite Estimates Methodology

B. AUTHORITY

A.R.S § 41-1954 A14, A15

C. MODEL

As the name implies, the general form of the composite method is based on a combination of methods for estimating different age groups and the total household population is arrived at by summing the different age groups. Censal-ratio methods are used separately to estimate the following populations: under 5 years; 5 to 17 years; 18 to 64 years; and 65 years and older. Different data series are used with each age group: vital statistics for persons under 5 years; school enrollments for the 5 to 17 age group; drivers' licenses for persons aged 18 to 64; and Medicare enrollments for persons 65 years and older.

1. Under 5 years of age.

Data on births and deaths for the cohort of persons aged 0 to 4 years at the time of the Census are used to estimate the number of persons in this age group. There is a lag in the availability of administrative data on births and deaths such that final data are 6 months behind the date for which estimates must be prepared. Therefore in order to establish a Censal Ratio that incorporates this lag, the vital statistics data are used to create a cohort aged 0 to 4 on October 1, 1999. This is the sum of the births between 10/1/1994 and 10/1/1999 minus the sum of deaths to persons born over that interval.

Vital Statistics Cohort Aged 0 to 4 on October 1, 1999
= Sum of Births – Sum of Deaths

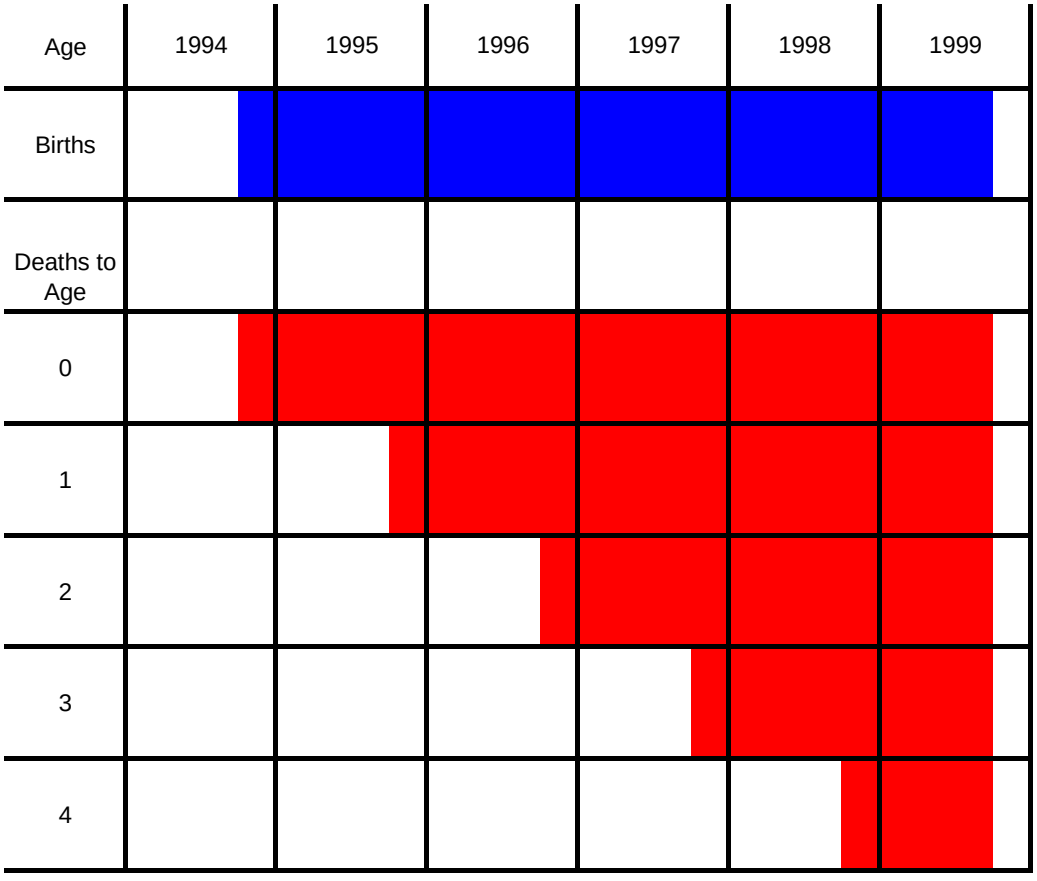
Sum of Births =
1/4 of Births in 1994 +
All Births 1995 through 1998 +
3/4 of Births in 1999

Sum of Deaths =
1/4 of Deaths to infants (under 1 year of age) in 1994 +
All Deaths to infants 1995 through 1998 +
3/4 of Deaths to infants in 1999
+
1/4 of Deaths to persons aged 1 in 1995 +
All Deaths to persons aged 1 in 1996 through 1998 +
3/4 of Deaths to persons aged 1 in 1999
+

1/4 of Deaths to persons aged 2 in 1996 +
All Deaths to persons aged 2 in 1997 and 1998 +
3/4 of Deaths to persons aged 2 in 1999
+
1/4 of Deaths to persons aged 3 in 1997 +
All Deaths to persons aged 3 in 1998 +
3/4 of Deaths to persons aged 3 in 1999
+
1/4 of Deaths to persons aged 4 in 1998 +
3/4 of Deaths to persons aged 4 in 1999

These calculations yield an estimate, based on Vital Statistics, of the cohort of persons aged 0-4 that have survived from birth. The calculations described by the formulas above are graphically presented in Figure 1.

Figure 1. Calculation of Vital Statistics Cohort Aged 0 to 4 on October 1, 1999.



The ratio of the vital statistics cohort to the census count can be used to estimate the size of this age group for subsequent years. The difference between the vital statistics cohort and the census count can be attributed to migration and errors in the component data and model.

Censal Ratio =
Census count of household population aged 0 to 4 /

Vital Statistics cohort aged 0 to 4

In order to estimate the household population of persons aged 0 to 4 at a subsequent date, for example July 1, 2005, complete the following calculations.

Births 2000 to 2004 =
All Births 2000 - 2004

Deaths 2000 to 2004 =
Deaths to infants 2000 - 2004
+
Deaths to persons aged 1 in 2001 - 2004
+
Deaths to persons aged 2 in 2002 - 2004
+
Deaths to persons aged 3 in 2003 - 2004
+
Deaths to persons aged 4 in 2004

Vital Statistics cohort aged 0 to 4, Jan 1, 2005 = Births – Deaths

Censal Ratio Estimate of Household Population Aged 0 to 4 on July 1, 2005 =
Vital Statistics cohort aged 0 to 4, Jan 1, 2005 * Censal Ratio

2. <u>5 to 17 years of age</u>.

Data on school enrollment for grades K-12—reported for a point in time, October 1—are used as an indicator of change for persons aged 5 to 17 years. October 1 is widely used by states and the federal government as the standard date for reporting school enrollment. This means the school enrollment data refer to a date that is 9 months prior to the estimates date of July 1. The ratio of school enrollment to the Census count of persons in the household population aged 5 to 17 years therefore should ideally be calculated with this 9 month lag, which would be July 1, 1999 for the April 1, 2000 Census. However there are not consistent data on school enrollment available prior to October 1, 1999 and therefore the October 1, 1999 are used to calculate the ratio.

Censal Ratio = Census 2000 count of household population aged 5 to 17 / School Enrollment on October 1, 1999.

In order to estimate the household population of persons aged 5 to 17 at a subsequent date, for example July 1, 2005, complete the calculations below. The estimate does not refer literally to July 1, 2005 when most students are on summer vacation; rather it is a mid-point in the calendar year.

Censal Ratio Estimate of Household Population Aged 5 to 17 on July 1, 2005 =
School Enrollment on October 1, 2004 * Censal Ratio.

3. <u>18 to 64 years of age</u>.

Data on licensed drivers—reported for a point in time, July 1—are used as an indicator of change for persons aged 18 to 64 years. In order to establish the ratio of drivers' licenses to the Census count of persons in the household population aged 18 to 64 years, it is necessary to estimate the number of licensed drivers for April 1 of the Census year by interpolating.

Estimate of Licensed Drivers on April 1, 2000 =

¾ of (Licensed Drivers on July 1, 2000 – Licensed Drivers on July 1, 1999) +

Licensed Drivers on July 1, 1999.

Censal Ratio = Census 2000 count of household population aged 18 to 64 / Licensed Drivers on April 1, 2000

In order to estimate the household population of persons aged 18 to 64 at a subsequent date, for example July 1, 2005, complete the following calculations.

Censal Ratio Estimate of Household Population Aged 18 to 64 on July 1, 2005 = Licensed Drivers on July 1, 2005 * Censal Ratio.

4. 65 years and older.

Data on Medicare enrollments for the aged are used as an indicator of change for persons in the household population aged 65 years and older. There is a lag in the availability of administrative data on Medicare enrollment such that the data are 12 months behind the date for which estimates must be prepared. Therefore in order to establish the ratio of Medicare enrollees to the Census 2000 count of persons in the household population aged 65 years and older that incorporates this lag, it is desirable to create an estimate of Medicare enrollment for April 1, 1999. A consistent data series on Medicare enrollment are not available prior to 1999 and therefore the July 1, 1999 data on Medicare enrollment are used.

Censal Ratio = Census 2000 count of household population aged 65+ / Medicare Enrollees on July 1, 1999.

In order to estimate the household population of persons aged 65 years and older at a subsequent date, for example July 1, 2005, complete the following calculations.

Censal Ratio Estimate of Household Population Aged 65+ on July 1, 2005 = Medicare Enrollees on July 1, 2004 * Censal Ratio.

D. INPUT DATA

1. Under 5 years of age: Vital Statistics.

The data on births and deaths by single year of age are produced by the Arizona Department of Health Service. The Department of Health Services maintains a web site with vital statistics information at http://www.azdhs.gov/plan/. Data on live births by mother's county of residence are provided in Table 5B-3, and for deaths by resident county and age are provided in Tables 5E-15 and 5E-16. The data needed for these calculations require deaths by single year of age. The Department of Health Services provide these data to AZDES by a special tabulation.

The data are produced by calendar year and there is a lag between the end of the calendar year and the availability of these data in final form. Provisional data are available with only a 1-2 month lag, but the data are subject to revision before they become final and official. The lag of 6 months between the vital statistics and the date of the estimates is acceptable.

2. 5 to 17 years of age: School Enrollments.

The data on school enrollments are produced by the Arizona Department of Education. The Department of Education maintains a public access web site, with the October 1st enrollment figures for current and prior years at, http://www.ade.az.gov/researchpolicy/AZEnroll/. The Research & Evaluation Section of the Department of Education collects and prepares these data. School districts report their head count of all active enrollments on October 1st of each school year.

a. Charter Schools.

The potential problem is with coverage and whether students attending charter schools are included in the enrollment data. Charter schools, permitted by the Arizona School Improvement Act of 1994, serve as alternatives to traditional public schools. The data on enrollment include students enrolled in both traditional district and charter schools.

b. Open Enrollment.

The potential problem is that students may be enrolling in schools not in their county of residence, and that there may have been substantial change in cross county enrollment since the Census 2000. Such a change could affect data quality with respect to coverage and consistency. "The Arizona School Improvement Act of 1994 (amended in 1995) mandates that public schools provide open enrollment opportunities throughout Arizona. The law was passed to allow parents/guardians to register their children in neighboring schools and school districts in an effort to give them a choice in school selection." (Source: http://www.prescott.k12.az.us/school_choice.htm)

In the Superintendent's Annual Report and the annual School Finance Reports prepared by the Arizona Department of Education there are breakdowns of students by resident and non-resident enrollment. These data are for average daily attendances which are not the same as the October 1 enrollment data. Rather it is the average daily membership for the first 100 days in session for students that attend school in the district. The data are broken down by students residing in the school district and those not residing in the school district. The classification of students as non-resident includes those residing in another school district in the same county as well as those residing in a school district outside the county. The report does not distinguish between these. The number reported for Attending Average Daily Membership is smaller than for October 1 Enrollment Counts because it is based on the average of actual daily attendance, not the total number of students enrolled in the schools.

Assessing Impact of Open Enrollment

	Maricopa County			Pinal County		
Fiscal Year	October Enrollment	Resident ADA	Non-Resident ADA	October Enrollment	Resident ADA	Non-Resident ADA
1999-2000	519,222	470,781	1,840	27,377	25,176	182
2000-2001	544,617	481,013	2,025	25,889	25,436	159
2001-2002	565,517	497,091	2,092	28,564	26,568	215
2002-2003	600,577	514,044	2,232	33,006	27,458	253
2003-2004	626,461	528,062	2,445	33,250	28,357	182
2004-2005	657,958	574,545	3,239	35,408	30,182	175

Source: Arizona Department of Education, Superintendent's Annual Report for 1999-2000 through 2003-2004; Financial Report for 2004-2005

In order to explore the potential impact of open enrollment we have created the table above. Jack Tomasik of the Central Arizona Association of Governments has stated that increasing numbers of students residing in Pinal County are open enrolling in schools located in Maricopa County, and so we have chosen to compare data for these two counties.

The columns we focus on are Non-Resident ADA for Maricopa County and October Enrollment for Pinal County. For Maricopa County, the level of average data attendance (ADA) among students living outside the school district in which

they are enrolled increased from 1,840 in the 1999-2000 Fiscal Year to 3,239 in the 2004-2005 Fiscal Year. We used the October 1 enrollment for FY1999-2000 in combination with the Census 2000 to establish the censal ratio and the October 1 enrollment for FY2004-2005 to estimate the youth population for 2005. If the proportion of students open enrolling outside their county of residence (Pinal County) increased between FY1999-2000 and FY2004-2005 then the Censal Ratio would underestimate the youth population by a similar proportional difference.

The Non-Resident ADA includes students living in the county but in another school district as well as students living in other counties. If however the entire Non-Resident ADA in Maricopa County were accounted for by students residing in Pinal County then they would have represented 6.7 percent of Pinal County's October Enrollment in FY1999-2000 and increased to 9.1 percent of Pinal County's October Enrollment in FY2004-2005, then the enrollment figures would be 2.4 percent too low. That appears to be the most extreme case.

For Pinal County the Censal Ratio of Census count of household population aged 5 to 17 years to October Enrollment is the third highest in the state, behind Apache and Coconino Counties. The high ratio is consistent with a high proportion of students open enrolling outside the county, but if that is the case it appears that the Census Ratio is already taking account of much of that. The impact of Open Enrollment across county boundaries does have potential for affecting the estimates of youth population and should be examined in greater detail and monitored over time.

c. Duplicate Counts.

The Department of Education states,

"Please note these counts are not unduplicated counts; concurrently enrolled students are counted as having an active membership in each school. Also, be aware there was a change in data collection in 2003. From 2003 forward, concurrent enrollments in technology schools are included, which may additionally overstate aggregated enrollment figures." (Source: http://www.ade.az.gov/researchpolicy/AZEnroll/)

To the extent that there are substantial difference between counties in the duplicate counting of students and that these differences have changed since the Census 2000 they could be a source of error in the estimates process. With the available data there is no way to evaluate this potential source of error.

3. 18 to 64 years of age: Drivers' Licences.

The data on drivers' licenses are produced by the Motor Vehicle Division of the Arizona Department of Transportation (AZ MVD). The Motor Vehicle Division maintains a web site with drivers' license statistics at http://www.azdot.gov/mvd/statistics/driverLicense.asp and the report series used is MV-708. The count of drivers' licenses used for these estimates is for a point-in-time, July 1 and is for all licenses (commercial and non-commercial) on file as of that date. There is a lag of 1 week between the reference and publication dates.

There are three data quality issues affecting the use of these data for estimating county population. First, between 2003 and 2004 there was a change in the programming logic used by AZ MVD resulting in a substantial difference between the prior and succeeding years. In the terminology of time series data analysis this was an abrupt and permanent difference and requires that an adjustment be made to the time series in order that the data are comparable for purposes of establishing census ratios and estimating population in subsequent years.

The Strategic Planning and Statistical Research Unit of the AZ MVD have stated the following:
Please be advised that this report (MV708) was reformatted In February 2004 to include a breakout of commercial vs. non-commercial licenses by county, among other changes. In addition, all counts were validated via programming checks and balances. In the process of this validation effort, it was discovered that previous years' reports contained counts that were questionable, due to differences in programming logic. For example, in January 2004, when the older report structure was still in place, some counts of identification cards and driver license categories were moderately to significantly higher than were presented in the reformatted and validated February 2004 report.
As a result of our findings at the time, we determined that it would be best to not publish the older reports since they could not be reliably compared with the newer reports. The FY 1999-2003 reports are certainly comparable, since they all utilize the same programming; likewise, the FY 2004 report is comparable with 2005. However, when looking at a breakout by counties, reports from earlier years do not distinguish between commercial and non-commercial licenses. Furthermore, it is not possible to recreate data for earlier years using the newer report format. This is because the data is strictly "point-in-time." License status codes applied to today's records cannot be reconstructed to reflect what was true of yesterday's records. Additionally, records purged today cannot be recreated to reflect yesterday's records, either. Such is an unfortunate limitation of our current mainframe system.

Second, the data for July 1, 2005 has an error in programming logic that resulted in an overstatement of the number of licensed drivers. In a message to AZDES on December 1, 2005 the Statistical Research Unit of the AZ MVD stated the following:

In February 2005, a programming change was made to the MVD database to identify counts of Active Military driver licenses, which impacted the MV708 report. This report provides point-in-time counts of driver credentials that are both current and valid. Inadvertently, programming was set to include, rather than exclude, expired Active Military driver credentials. Subsequently, overcounts occurred in most classes of driver credentials, but most especially in Class M: Motorcycle.

The error was not discovered until late October 2005, but reports issued in April, June, and October 2005 are all affected. This error has since been corrected. It is recommended that the MV708 report, dated 11/04/2005, be used to replace all April, June, and October 2005 reports.

Third, the annual series for counties, especially smaller counties showed considerable variability from year to year. We posed this question to staff in the MVD Statistical Research Unit and were told that counties do not follow a consistent schedule for updating their files and that can lead to a saw-tooth pattern in the data series.

In order to adjust the series to create comparable, consistent data by county for the years 1999 through 2005 we have done the following:

a. Estimate the corrected value for July 1, 2005 by linear interpolation between July 1, 2004 and November 4, 2005. The programming error led to an “overcount” in drivers licenses and we did not allow our process to produce higher estimates than were originally reported for a county. The major changes were a reduction in drivers licenses for Cochise, Maricopa, Pima and Yuma Counties.

b. Calculate and evaluate the data on “shares” of licensed drivers by county for the years 1999 through 2005. The data on shares were smoothed by taking a 3 year moving average. We do not have data prior to 1999 and so for the estimate of 1999 we used (1999 + 1999 + 2000) / 3. We do not have data after 2005 and so for the estimate of 2005 we used (2004 + 2005 + 2005) / 3.

c. Adjust the data on drivers' licenses for the State of Arizona, making estimates of the values for years 1999 through 2003 that are comparable with the data for 2004 and 2005. The annual rate of change for comparable years varied from a high of 4.1 percent for the period 1999-2000 to a low of 3.1 percent for the period 2004-2005. The average rate of change for the comparable years, 1999-2000, 2000-2001, 2001-2002, 2002-2003, and 2004-2005 was 3.5 percent and this value was used as an estimate of the rate of change for the period 2003-2004. The data were made comparable to 2004 and 2005 by using the rates of change (estimated for 2003-2004 and reported for earlier periods) to back down to 1999.

d. The estimates of drivers licenses by county for 1999 through 2003 were then derived using the smoothed shares from step 2 above to allocate the adjusted state totals to the counties.

Graphs of the adjusted data on drivers licenses compared to the original reported data are appended to the end of this report.

4. 65 years and older: Medicare Enrollments.

Data on Medicare Enrollments are produced by the Centers for Medicare & Medicaid Services (CMS) in the federal Department of Health and Human Services. The CMS maintains a web site with enrollment statistics at http://www.cms.hhs.gov/statistics/enrollment/. The relevant data series is for Aged persons (65+ years of age), the unduplicated count of persons enrolled in either or both Part A - Hospital Insurance (HI) and Part B - Supplemental Medical Insurance (SMI) programs. The unduplicated count is equal to the sum of persons aged 65 years and older enrolled in Part A Only; Part A & Part B; and Part B Only.

The data are a point-in-time count as of July 1 of the reference year, and there is a substantial lag between the reference date and the availability of these data. In the absence of current data for the estimate, the most recent data on Medicare Enrollment are used. For the 2005 estimates a 12 month lag has been used.

E. ESTIMATED EQUATIONS.

The Censal Ratios for each age group are calculated in the manner described above in Section 1 on the model. The following table presents a summary of the calculations for the State of Arizona.

Censal Ratio Estimates of Population Size	
	Arizona
Ages 0-4	
Censal Ratio =	1.015775
Census count of household population aged 0 to 4	381,833
/ Vital Statistics Cohort 10/1/1999	375,903
Ages 5-17	
Censal Ratio =	1.126236
Census count of household population aged 5 to 17	979,094
/ School Enrollment 7/1/1999.	869,351
Ages 18-64	
Censal Ratio =	0.928996
Census count of household population aged 18 to 64	3,014,134
/ Licensed Drivers 4/1/2000	3,244,508
Ages 65 and Older	
Censal Ratio =	1.119518
Census count of household population aged 65+	645,721
/ Medicare Enrollees 4/1/1999	576,785

The Censal Ratios vary by county. The following table presents the censal ratios for each age group for all counties.

Censal Ratios for Calculating Estimates of State and County Population

Censal Ratios For Calculating Estimates of Population Size				
	Age Group			
State/County	0-4	5-17	18-64	65+
Arizona	1.015775	1.126236	0.928996	1.119518
Apache	0.987889	1.317614	1.148089	1.061901
Cochise	0.951088	1.104378	0.742764	1.102149
Coconino	0.948464	1.213798	0.784802	0.752593
Gila	0.921755	1.028249	0.719779	1.026714
Graham	1.140105	1.178374	0.902118	1.064202
Greenlee	0.925490	1.019898	0.799646	0.901169
La Paz	1.122520	1.065312	0.769823	1.661317
Maricopa	1.031758	1.122714	0.977678	1.104683
Mohave	1.066279	1.117545	0.699282	1.119355
Navajo	0.987441	1.090940	0.949197	1.070980
Pima	0.983825	1.148954	0.911424	1.072030
Pinal	1.120842	1.194981	0.939526	1.392890
Santa Cruz	0.859762	0.992119	0.805405	0.978161
Yavapai	1.100561	1.087398	0.750642	1.161118
Yuma	0.878197	1.114948	0.965069	1.630740